CLAIMS

1. Method for synthetically calculating redundant attitude for an aircraft when the heading of the aircraft is known, with the aid of data existing in the aircraft, such as the angular rates p, q, r around the x-, y- and z- coordinates of an aircraft-fixed (body frame) coordinate system, air data information in the form of speed, altitude and angle of attack as well as heading information, **characterised in that** the method includes the steps:
- attitude is calculated on the basis of the aircraft-fixed angular rates p, q, r and
- the calculated attitude is corrected by means of air data and heading.

2. Method according to claim 1, **characterised in that** the heading information is obtained from a heading gyro.

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3. Method according to claim 1 or 2, **characterised in that** attitude is ~~integrated out~~ via information about the body-frame ~~angular rates~~ (p, q and r) obtained from the aircraft-fixed ~~angular~~ rate gyros of the aircraft.

4. Method according to claim 3, **characterised in that** correction of the integrated-out attitude takes place with the aid of attitude calculated on the basis of air data information and heading information.

5. Method for synthetically calculating redundant attitude and redundant heading for an aircraft with the aid of data existing in the aircraft, such as the angular rates p, q, r around the x-, y- and z- coordinates of an aircraft-fixed (body frame) coordinate system, air data information in the form of speed, altitude and angle of attack, **characterised in that** the method includes the steps:
- attitude and heading are calculated on the basis of the body-frame angular rates p, q, r
- the errors in the measured body-frame magnetic field vector components are estimated,
- the measured body-frame field magnetic field vector is derived,
- errors in calculated attitude and heading are estimated with the aid of air data and derived measured body-frame magnetic field vector components and
- the calculated attitude and heading are corrected by means of estimated errors in attitude and heading.

6. Method according to claim 5, **characterised in that** attitude andr heading are integrated out via information about the aircraft's body-frame angular rates (p, q and r) obtained from the aircraft's body-frame angular rate gyros.

7. Method according to claim 5, **characterised in that** estimation of errors in measured body-frame magnetic field vector components is performed in a first filter (11).

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8. Method according to claims 6 or 7, **characterised in that** in a second filter (22) is performed estimation of attitude errors and heading errors that arise on integration of the aircraft's body-frame angular rates (p, q and r) obtained from the aircraft's body-frame angular rate gyros, where the estimation is done with the aid of attitude calculated from air data information as well as derived measured body-frame magnetic field vector components.

9. Method according to claims 7 or 8, **characterised in that** the filtering takes place with the aid of Kalman filters.

10. Arrangement for synthetically calculating redundant attitude for an aircraft when the aircraft's heading is known, with the aid of data existing in the aircraft such as the aircraft's body-frame angular rates (p, q and r), air data including at least speed, altitude and angle of attack as well as heading information, **characterised in that** the arrangement includes an integration routine (8) to integrate out the aircraft's attitude from information about the aircraft's body-frame angular rates (p, q and r) as well as that the calculated attitude is corrected by means of reference attitude from air data and redundant heading.

11. Arrangement according to claim 10, **characterised in that** the heading information is obtained from a heading gyro.

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12. Arrangement according to claim 10 or 11, **characterised in that** integration routine (8) integrates out the aircraft's attitude from the aircraft's body-frame angular rates (p, q and r) obtained from the aircraft's body-frame angular rate gyros.

13. Arrangement according to claim 12, **characterised in that** the integration routine (8) is fed with the zero-error-compensated body-frame angular rate gyro signals.

14. Arrangement according to claim 10, **characterised in that** a reference attitude is calculated with air data information as well as redundant heading information.

15. Arrangement according to claim 10, **characterised in that** a synthetically-generated corrected attitude is obtained by generating a difference between the attitude obtained from the integration routine (8) and an error signal that represents the error between the integrated attitude and the reference attitude.

16. Arrangement for synthetically calculating redundant attitude and redundant heading for an aircraft with the aid of data existing in the aircraft such as measured body-frame field vector components, the aircraft's body-frame angular rates (p, q and r) as well as air data including at least speed, altitude and angle of attack, **characterised in that** the arrangement includes a first measurement routine (10) which transforms the measured body-frame magnetic field vector components to the aircraft's navigation system (navigation frame), a first filter (11) which estimates the errors in the calculated measured body-frame field vector components, an integration routine (20) for integrating out the aircraft's attitude and heading from information about the aircraft's body-frame angular rates (p, q and r), a second filter (22) for estimating the errors arising in attitude and heading obtained in the said integration and a second measurement routine (21) for calculating attitude and heading from air data and derived measured body-frame magnetic field vector components.

17. Arrangement according to claim 16, **characterised in that** the first measurement routine (10) is fed with the measured body-frame magnetic field vector components, as well as attitude and heading from the aircraft's normal navigation system and transforms the measured body-frame magnetic field vector components to the aircraft's navigation frame.

18. Arrangement according to claim 17, **characterised in that** the first filter (11) is fed with information from the first measurement routine (10) and estimates the errors in the measured body-frame magnetic field vector components.

19. Arrangement according to claim 16, **characterised in that** the integration routine (20) integrates out the aircraft's attitude and heading from the aircraft's body-frame angular rates (p, q and r) obtained from the aircraft's body-frame angular rate gyros.

20. Arrangement according to claim 16, **characterised in that** the second measurement routine (21) is fed with air data, the derived measured body-frame magnetic field vector components and with information about the aircraft's body-frame angular rates (p, q and r) and from these values calculates an attitude and a heading.

21. Arrangement according to claim 20, **characterised in that** the second filter (22) is fed with information from the second measurement routine (21) and estimates the errors in attitude and heading as well as zero error in body-frame angular rate gyro signals and residual errors in the measured body-frame magnetic field vector components for generating an error signal.

22. Arrangement according to claim 21, **characterised in that** a synthetically-generated corrected attitude and heading are obtained by generating a difference between
- the attitude obtained from the integration routine (20) and heading and
- the error signal from the second filter (22).

23. Arrangement according to claim 19, **characterised in that** the integration routine (20) is fed with body-frame angular rate gyro signals compensated for estimated zero errors.

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24. Arrangement according to any of claims 16 - 23, ~~**characterised in that** the first filter (11) and/or the second filter~~ (22) consists of a Kalman filter.